Newcastle University ePrints

Parry D, Walsh C, Larsen C, Hogan J. [Reflective Practice: a place in enhancing learning in the undergraduate bioscience teaching laboratory?](#)

Bioscience Education 2012, 19: 3

Copyright:

The definitive version of this article, published by the Higher Education Academy, 2012, is available at:

<http://dx.doi.org/10.11120/beej.2012.19000004>

Always use the definitive version when citing.

Further information on publisher website: <http://journals.heacademy.ac.uk/>

Date deposited: 4th February 2014

Version of file: Published

This work is licensed under a [Creative Commons Attribution-NonCommercial 3.0 Unported License](#)

ePrints – Newcastle University ePrints

<http://eprint.ncl.ac.uk>

Research Article

Reflective Practice: a place in enhancing learning in the undergraduate bioscience teaching laboratory?

Damian Parry, Cathy Walsh, Carl Larsen and Joanne Hogan

Department of Health Sciences, Liverpool Hope University

Date received: 19/01/2012

Date accepted: 19/04/2012

Abstract

Bioscience employers demand graduates with better practical competence. It is our supposition that, although undesirable, student learning is assessment driven and this is leading students to simply go through the motions in the practical setting (whether field work or laboratory based). In this intervention a Critical Incident Report was introduced as an addition to a traditional laboratory report to encourage students to reflect on practical skills rather than theoretical application. Our research suggests that mark accumulation, linked in this case to report writing, is becoming the focus of students 'learning economy'. The critical incident analysis enhanced students' awareness of reflective practice, but did not generate a perceived increase in reflection on laboratory skills themselves, as evidenced through the questionnaire responses. Qualitative data clarified that students increased their use of reflection to enhance 'mark generation' rather than skills bases. Reflective practice takes time and requires support in the learning environment. Students stated that critical incident analysis, carried out in the laboratory during the practical session, would be useful as a tool to deepen their reflective practice. Overall, this type of reflection may represent an effective tool through which to enhance practical skills and should be further explored in the laboratory context.

Keywords: reflection, critical incident, practical setting

Introduction

Addressing the skills gaps highlighted by employers of UK undergraduate science graduates remains one of the key challenges for educators (Association of the British Pharmaceutical Industry, 2008). There is a constant and understandable pressure to generate graduates that are both theorists and skilled practitioners in the laboratory, for example SEMTA (2010) stated that "17% of SEMTA employers felt graduates were poorly prepared for work mainly in terms of practical skills". In response, higher education providers have worked to maintain or increase the volume of practical work in the curriculum, and an average undergraduate science student engages in 6.48 ± 0.12 hours ($n = 677$ students) of practical work per week during their first year studies (Collis *et al.*, 2007). However, 26 of the 47 employer respondents in the ABPI survey commented that practical experience remained an issue of significant concern.

Framed within this arena, some academics have begun to question the traditional approach of assessing practical activities in bioscience disciplines through report writing. Adams (2009) noted that there was "a pressing need to re-think the traditional approach to bioscience laboratory teaching in UK higher education" (pg. 1). This resonates with the feelings of many academics that practical reports, although based on an engaging task, have somewhat lost their way as tools to deepen students approach to learning. Adams (2009) goes on to recommend that educators move towards more stimulating and challenging approaches to laboratory practical work which enthuses students and encourage them to develop a deeper engagement with practical tasks. As he highlights, there is considerable evidence of good practice across the international science education arena, including the use of enquiry based and e-learning in support of laboratory classes.

In the wider pedagogical literature there is clear evidence that deeper learning is strongly associated with critical analysis, application and evaluation, including (for references see Houghton and Warren, 2004); Biggs (1999), Entwistle (1988) and Ramsden (1992). In clinical settings, it is well recognised that deep learning is enhanced through reflection; reflective practice harnesses critical reflection and requires an individual to place themselves in the practice setting and reflect both before, during and after the experience in order to foster transformational learning (Tate, 2004).

Until recently reflective practice has largely been neglected by the bioscience community, with few exceptions including the e-portfolio work reported by (Speake *et al.*, 2007). As far as the authors know, using reflective practice to deepen learning within the laboratory setting has never been reported. At first glance this may appear to marry together two immiscible conceptual frameworks however, there is a considerable body of literature, largely founded in clinical education (an example of this is in Cote *et al.*, 2000), and business (an example of this literature is Fivars, 1980) in which the use of critical incident analysis fosters reflective practice to enhance 'practical' skills. This technique requires learners to reflect on a critical incident that occurs in a specialist setting, for example during a patient consultation, and analyse the factors that contributed to either successful or negative outcomes in a particular treatment regime. Critical incident analysis, furthermore, drives students towards an active form of learning rather and creates conditions that help overcome any inertia in an individual's learning style. Placed in the context of the undergraduate bioscience setting, reflective practice may represent a key mechanism through which to enhance active student learning, particularly in the laboratory setting. Interestingly, some twenty years ago in his critical review of practical work in science education (Hodson, 1990) recommended that students placed more importance on laboratory skills, and it would seem that reflective practice represents an opportunity to address this issue.

This study aimed to determine whether the addition of a critical incident report to a traditional practical write up, could enhance student reflective practice and deepen learning in a manner that a 'traditional' laboratory report does not encourage.

Materials and Methods

The vehicle for the study was a second year laboratory skills module running as part of the undergraduate curriculum in 2009-10; the course is focussed particularly on biochemistry and molecular biology practice. There were 25 students registered for this module; students were given the opportunity to opt out of the study at any point. Students are assessed through traditional reports and a laboratory book. This module is a compulsory part of the bioscience degree and they have previously experienced weekly laboratory classes throughout the first year of their programme and have experience of academic report writing.

The teaching and learning framework of this module is solely based on practical sessions, theory is taught through application rather than didactically. However, despite the emphasis placed on practical work in this module, it is our experience that many students arrive in the laboratory without reading through the practical procedure and often leave feeling that they have not gained from the prescriptive process. In order to fully engage students with skill acquisition a critical incident report was added as a required element of each practical written up for assessment. Briefly, using a prepared proforma (Figure 1 contains an exemplar), students were required to consider the context of a critical incident (Davies and Kinloch, 2000) that occurred during the practical, they then reported the incident itself, why the incident was significant, what actions contributed to the incident, what was the outcome and how the incident might affect future behaviour in the laboratory context in the future. It was made clear

to students that the incident need not be a negative aspect, something that went wrong, but could equally be positive occurrences, something that went well.

<p>Name:</p> <p>Practical: <i>Preparation of a standard curve for a DNSa assay of carbohydrate content</i></p> <p>Date carried out:</p> <p>Location:</p> <p>Did the practical generate the outcomes intended and explain your response: <i>no, the standard curve was not a straight line when plotted out; the value for the tubes containing 1 and 5 mM glucose solution did not change colour; they had an absorbance lower than the blank which was not what we had expected.</i></p> <p>List the critical incidents in this protocol: <i>volume measurement for glucose solution, water, DNSA reagent; detail of incubation period; colorimetric analysis; data reporting;</i></p> <p>Considering each of the items listed above, briefly reflect (honestly) on how the practical was carried out at each of these stages: <i>the water bath had not reached boiling point, it was showing 80°C, however all tubes were incubated together in the one bath at this temperature and so this could not have resulted in just two tubes failing to change colour. The volume measurements were made by three different people, using different pipettes, the pipette filler that Dave used was difficult to use as liquid was dripping from the end. I did not check the label on the glucose solution because I was distracted talking about something else, I'm not absolutely sure that I used the reducing sugar rather than the non-reducing sugar that we needed for the next practical. All of the tubes went into the same colorimeter, one after the other and they were all blanked against the same tube. I think that if there was a problem here that it would not have been just 2 tubes that were affected. We reread the tubes at the end when the results were not what we thought, we got the same readings again.</i></p> <p>Following the above reflection what have you established to be the critical incident: <i>Non-reducing sugar does not record in this assay, DNSa requires a reducing sugar in order to change colour. I think it is most likely that I used the wrong sugar solution; the others who were also measuring out used the right one. I also was not very accurate when I measured out the volumes of the solutions, the pipette filler was not working properly.</i></p> <p>Write 3 bullet points that illustrate how your reflections on this practical will affect your future behaviour in the laboratory context in the future:</p> <ul style="list-style-type: none"> - <i>I will make sure that the entries in my lab book actually provide a detailed record of which solutions were used. I have not paid much attention to this detail so far and that made it difficult for our group to work out what we had added to the tubes, whether it was glucose or sucrose that we put in the tubes that didn't work.</i> - <i>I will read the practical before I come to the session so that I have a good idea of what I am doing before I start off: I didn't really understand why I needed to use glucose for the standard curve and then use sucrose for the actual experiment.</i> - <i>I shouldn't settle for using a piece of equipment that is not working properly; if the filler is leaking I realise now that just a small amount of volume lost can really change the results as the assay is very sensitive.</i>

Figure 1 Critical Incident Analysis Exemplar

Example responses are italicised in response to the formal structure of the proforma which is emboldened.

Tables 1 A and B Participant response to clicker prompt questions on reflection expressed as a percentage of the total respondents

A)

Question	Pre-Intervention % Respondents			Post-Intervention % Respondents		
	Agree	Neutral	Disagree	Agree	Neutral	Disagree
I always enjoy laboratory sessions	84	16	0	84	0	16
I find practical work in the laboratory to be a stimulating learning experience	88	4	8	90	0	10
find it easier to learn by doing practical work than from going to lectures	60	16	24	60	24	16
Before a laboratory practical I aim to read through the practical schedule, if available	64	16	20	58	18	24
Before a laboratory practical I aim to read around the subject so that I understand the practical	68	8	24	58	12	30
When I am in the laboratory I follow the schedule without understanding what I am doing'	8	60	32	13	62	25
After a practical I always follow up by reading around the subject	36	12	52	64	18	18
After a practical I always reflect on what went well and what did not go well	84	8	8	64	24	12
I tend just to learn things without thinking about the way I learn best	40	16	44	64	0	36
I think about what I want to get out of my studies so as to keep my work well focused.	40	12	48	76	18	6
If I'm not understanding things well enough when I'm studying I try a different approach.	44	24	32	70	6	24
I pay careful attention to any advice or feedback I'm given, and try to improve my understanding.	72	24	4	94	6	0
I look at evidence carefully to reach my own conclusion about what I'm studying.	72	16	12	94	6	0
I often talk with other students about how I am learning and how I might improve.	50	38	12	58	18	24

B)

The most important attribute of a good bioscientist is to	be skilled in the laboratory	be able to analyse data	have a good theoretical understanding	be able to apply understanding to a range of settings
Pre-Intervention (%)	44	22	30	4
Post-Intervention (%)	18	6	47	29

The intervention was evaluated in two ways: firstly, a Personal Response System (PRS) with 'clicker' prompted questions to determine student's perceptions of the value of reflection and their engagement with practical work at the start of the course. The set of questions was adapted from an on line pool and comprise the questions detailed in Tables 1A and 1B (McCune, undated). The same set of clicker questions were administered again at the end of the module for comparison with the responses gathered at the start. Secondly, a small sample of students (n=6) were recruited to a focus group immediately after the submission of the first full practical report, and the receipt of feedback. All students on the course were invited to take part in the focus group; the group size included all those students who took up the intervention. The discussion of the focus group was transcribed and a thematic analysis used to identify students attitudes toward reflection and their perceptions about the use of reflection as a means of deepening their learning in the laboratory setting. This focus group was reconvened at the end of the module in order to determine any changes in student attitudes towards, and beliefs about, reflection in the laboratory setting.

This project was approved by the local departmental ethics committee with the proviso that students responses should not be identifiable, hence the use of the clicker format which is completely anonymous. The drawback to this system is that a statistical analysis, for instance a paired *t*-test of responses before and after the intervention, could not be carried out.

Results

The responses to the multiple choice questions, pre- and post-intervention are summarised in the Table 1. The first questionnaire was administered at the first taught session, 23 of a total of 25 students were present and all agreed to take part in the study. The second questionnaire was administered at the last session when 17 of the total 25 students were present; all consented to take part in the study again. As the class was relatively small and predominantly made up of female students, a completely anonymous response system was employed to ensure that male members of the group were not identified by default.

The questions relating to engagement with laboratory work showed little difference in response before and after the intervention, with one notable exception. Prior to undertaking this laboratory course, students felt that the most important attribute of a scientist was to be competent in the laboratory; after the intervention the response changed, more students now felt that being an accomplished theorist was of prime importance.

The questions relating to reflection were more interesting. After the intervention students were more likely to read around the subject material and considered more carefully what they would get out of my studies so as to keep well focused. However they reported reflecting less on what went well during the practical; and they were more likely to just learn things without thinking about the most appropriate learning style. Students also reported paying more careful attention to advice from tutors after the intervention and were more likely to use different approaches to enhance their understanding. In addition, after the intervention students spent more time looking at evidence in order to reach their own conclusions.

The focus groups provided valuable information in clarifying the changing attitude towards practical work and academic theory. Transcription of the focus groups enabled a thematic analysis of student comments; the key themes that emerged from the first focus group, carried out after one round of critical incident analysis were:

- a) lack of understanding of the term 'reflection' and as a consequence an apparent caution about the value of 'reflection'.

Students commented that they did not reflect in the broader sense, the critical analysis reflection was "just something that has to be done"; reflection was focussed on "what the tutor writes [on assessed work]". The overriding feelings of the group were that reflection was not relevant to them in relation to the laboratory skills course.

- b) focus on grades associated with written work

Students commented that the major focus for them was around the grade that they could achieve towards progression; "all you're thinking about is a particular assignment and trying to get the best grades"; "generally you don't bother about it [the critical incident form] you're only bothered about marks you get for the actual assignment".

The second focus group, convened at the end of the intervention, confirmed students caution about reflection but moved on to identify a place for reflection in a laboratory setting, suggesting

- a) critical incident analysis could be useful, particularly if carried out at the end of the session in which the practical was completed

There was a general agreement that the incident report could be better timed and could be useful if included as a group discussion at the end of practical class; "it would help to have a discussion to help us think about what went wrong" "different people see things a different way" "if it was part of the session I would think more about it".

- b) there was caution about reflection

Students' focus on tutor feedback was apparent with some caution about the value of self reflection as a valuable skill; "we don't get feedback on the critical incident report..... that's why it seems a bit of an add-on" "it's giving yourself feedback?".

Additional information relevant to the study was also collected. With reference to the last academic year, students were asked specific questions relating to engagement with their academic studies. A summary of their responses is shown in Table 2 below.

Table 2 a summary of demographic data relating to the student group

	Percentage Respondents				
	<20	21 to 24	25 to 29	30 to 34	35 +
how many hours did you spend on your studies each week?	64	32	4	0	0
	<10	11 to 14	15 to 19	20 to 24	25
how many hours of paid work did you carry out during term time?	24	28	20	12	16

A thematic analysis of a sample of the critical incidence forms completed by students in the study was also carried out and generated the following general areas of interest:

- a) Care and accuracy of measurements

Most students reflected on the need for accuracy; for example mentioning "the volume of water added when pipetting " as an area where they needed to focus their practical skills in future.

b) Planning before the practical

Students reflected on poor preparation and commented that reviewing the practical schedule before the taught session, with a particular eye for any areas where particular care was required, would have benefitted the final outcome.

Discussion

The value of reflection, as part of the learning cycle, is supported by many theorists; the work of Kolb (1984) is particularly well recognised. Initially, it appeared that the science students taking part in this study were reflective, 80% reported in the first questionnaire that they 'reflected after a practical'. However, in the first focus group, students reported that reflection was not relevant to them in the laboratory context. During discussion the focus group's participants acknowledged that they did not understand the term reflection and that they did not reflect independently, preferring instead to use tutor guided reflection through the process of feedback.

By the end of the module, only 64% of students felt that they did use reflection as part of the learning process; an apparent retrograde step from the 84% reporting reflective practice at the outset. However, the focus group carried out at this stage revealed that the students had developed more appreciation of the role of reflection. This suggests that when students understand what reflection is, they see the value of it but do not necessarily have the confidence to acknowledge that they are reflective practitioners. As McClure (2005) argues, reflective practice is a skill that must build and develop, students will subsequently transform reflection into deeper learning at different times and this may explain the apparent lack of confidence around reflection.

Interestingly, the increased reflexivity noted at the end of the intervention appeared to be focussed around theory rather than practical skills. There was a notable shift at the end of the intervention towards 'academic knowledge' as the primary skill of a scientist – around 44% considered theoretical knowledge to be paramount at the end of the course compared to only 30% at the start of the module.

The group of students used in this study reported that they carried out external paid work, with 76% working more than 10 hours per week during the academic year. Furthermore 96% of the cohort reported spending less than 24 hours per week on their studies. It may in fact be a necessity for a 'modern' undergraduate student to focus on maximising marks rather than on enhancing the depth of their learning. This in itself is interesting, if the nature of the undergraduate student is changing toward a focus on efficiency of learning then educators need to respond by placing more summative emphasis on reflective practice if it is to be encouraged. Another of the themes from the first focus group was the 'add on nature of the critical incident analysis'; the fact that summative assessment in the biosciences rarely demands inclusion of reflective practice compounds the student's lack of respect and engagement for the process. As the assessment weighting was carried by the theoretical depth of the practical report, an 'economical' approach to learning would indeed focus on the theory and not on the actual skills that generated the data in the laboratory.

The critical incident analysis enhanced student's awareness of reflective practice, but did not generate a *perceived* increase in reflection on laboratory skills themselves, as evidenced through the questionnaire responses. Analysis of the comments generated by the students on the critical incidence forms, suggested that they did in fact reflect on their skills. Later, during qualitative interviews students focussed on reflection to enhance 'mark generation' rather than skills bases; it therefore seems that reflection on skills themselves is 'short lived' and is replaced in the longer term by a 'results-centred' approach based around assessment requirements.

In the focus group carried out at the end of the intervention students reported that the critical incident reflection would be better if it were an integral part of the laboratory session. This comment fits with published literature (McClure, 2005) that students should be encouraged to reflect in the practice environment, in this case the laboratory, rather than after the session when they have moved onto the more theoretical part of the practical experience.

A significant juxtaposition in the student responses to the clicker questions was noted in the post-intervention questionnaire. Whilst students reported that, after the intervention, they increasingly tended just to learn things without thinking about the way I learn best'. It was also said that at the end of the module 'If I'm not understanding things well enough when I'm studying I try a different approach'. These responses seem to contradict each other, with the first suggesting a lack of reflection whilst the second indicating that the students had developed in this sense. However, the disparity could lie in the student's appreciation of the difference between learning and understanding. From induction onwards we emphasise that a primary difference between secondary and tertiary education is the increased emphasis placed on understanding. At pre-university education the emphasis tends to be on surface learning, which is in part encouraged through current methods of assessment that are focussed towards examination (Sims, 2006). At university level, however, with emphasis on questioning and research there is a requirement for more 'depth of understanding' and the student's apparently contradictory responses may reflect an appreciation of this.

Our supposition that students increased their skills of reflexivity, although this was focussed around theoretical rather than practical skills, is supported by the student's response to being asked about tutor advice. The students became more appreciative and responsive to tutor feedback after the intervention than before, which links the students desire to 'think about what (they) want to get out of (their) studies so as to keep (their) work well focused'. In addition, when asked about their deeper understanding of the subject almost all students reported that (they) 'look at evidence carefully to reach (their) own conclusions about what (they) are studying'. It seems therefore that students had increased their skills as reflective practitioners, but around the assessment-linked theory rather than practical skills *per se*.

Whilst this is the report of a 'case study' carried out with a relatively small cohort of students, our initial findings are valuable. The study could be expanded, using the same methodology, into a larger cohort size and into groups with more or less undergraduate experience. This would enable a wider quantitative base to be established for statistical analysis and also facilitate the convention of a larger number of focus groups. However, as educators of future scientists, our findings highlight the need to consider whether the traditional report following a practical is fit for purpose in a climate where employers place great value on skilled bench workers. Our research suggests that mark accumulation, linked in this case to report writing is becoming the focus of students 'learning economy'. This may potentially widen the skills gaps already identified by employers in the sector rather than closing them. Reflective practice, through critical incident analysis embedded in the laboratory practical itself, may provide a framework in which students can develop self-reflection both in terms of their practical approaches and also more generically in their theoretical application. Students were clearly more reflective at the end of the intervention but did not consider themselves to be 'reflective practitioners'. Similarly, in the critical incidence forms students were focussed on practical laboratory skills but this focus quickly shifted to reflection on academic theory as the summative report became their focus.

Whilst Abrahams and Millar (2008) urged educators to consider the effectiveness of laboratory work, "even if the task is carried out as intended and the apparatus functions as it is designed to do the students may still not think about the task and the observations they make" (pg.

1498). Critical incidence analysis, carried out at the time of the practical activity, may represent an effective tool through which to address the concerns of both academics and employers of future scientists.

Acknowledgements:

This work has been funded by a grant from the Teaching Development Fund of the Higher Education Academy.

Communicating Author: Damian Parry, Department of Health Sciences, Liverpool Hope University, Hope Park, Liverpool, UK L16 9JD; parryd1@hope.ac.uk

References

- Abrahams, I. and Millar, R. (2008) Does Practical Work Really Work: A study of the effectiveness of practical work as a teaching and learning method in school science. *International Journal of Science Education* **30**(14): 1945-1969
- Adams, D. (2009) Current Trends in Laboratory Classes in University Biosciences Programmes *Bioscience Education* **13**-3 www.bioscience.heacademy.ac.uk/journal/vol13/beej-13-3.aspx (Accessed 31st October 2011)
- Association of the British Pharmaceutical Industry (ABPI) (2008) *Sustaining the skills pipeline in the pharmaceutical and biopharmaceutical industries*. www.abpi.org.uk/publications/pdfs/2005-STEM-Ed-Skills-TF-Report.pdf (Accessed 15th June 2010)
- Collis, M., Gibson, A., Hughes, I., Sayers, G. and Todd, M., (2007) The student view of first year laboratory work in biosciences. The Centre for Bioscience www.bioscience.heacademy.ac.uk/resources/themes/1styrpracticals.aspx (Accessed 31st October 2011)
- Cote, C., Notterman, D.A., Karl, H.W., Wienberg, J.A. and McCloskey C. (2000) Adverse Sedation Events in Pediatrics: a critical incident analysis of contributing factors. *Paediatrics* **109**(4): 805-814
- Davies, H. and Kinloch, H. (2000) Critical Incident Analysis. In *Transfer of Learning in Professional and Vocational Education* Eds Cree V.E. and Macauley C., Routledge, London
- Fivars, G. (Ed.) (1980), *Critical Incident Technique*, American Institutes for Research, Washington, DC
- Hodson, D. (1990). A critical look at practical work in school science. *School Science Review*. **70** (256), pg. 33-40
- Houghton, W. (2004) Engineering Subject Centre Guide: Learning and Teaching Theory for Engineering Academics. Loughborough: HEA Engineering Subject Centre. www.heacademy.ac.uk/resources/detail/subjects/engineering/learning-and-teaching-theory (Accessed 31st October 2011)
- Kolb, D.A. 1984. *Experiential learning: experience as the source of learning and development*. Englewood Cliffs, New Jersey: Prentice-Hall
- McClure, P. (2005) *Reflection on Practice* www.science.ulster.ac.uk/nursing/mentorship/docs/learning/reflectiononpractice.pdf (Accessed 31st October 2011)
- McCune, V. (undated) University of Edinburgh College of Science and Engineering Clicker Questions to Prompt Reflection on Learning. www.scieng.ed.ac.uk/LTStrategy/resources/Clicker%20Questions%20to%20Prompt%20Reflection%20on%20Learning.doc (Accessed 31st October 2011)
- Sims E, 2006 Deep Learning 1: a new shape for schooling Specialist Schools and Academies Trust [www.sst-inet.net/PDF/Deep%20Learning%201%20 %20Chapter%201.pdf](http://www.sst-inet.net/PDF/Deep%20Learning%201%20%20Chapter%201.pdf) (Accessed 31st October 2011)
- Speake, T., Fostier, M. and Henery, M. (2007) The use of reflective practice to support a final year team research project in biosciences. *Proceedings of the Science Learning and Teaching Conference 2007* ftp://www.bioscience.heacademy.ac.uk/events/slsc07/proceedings_full.pdf (Accessed 31st October 2011)

Tate, S., (2004) Using critical reflection as a teaching tool. In: *The development of critical reflection in the health professions*. Occasional paper (4) eds Tate, Sylvina and Sills, Margaret, (eds.) Learning and Teaching Support Network (LTSN) Centre for Health Sciences and Practice. www.health.heacademy.ac.uk/publications/occasionalpaper/occasionalpaper04.pdf (Accessed 31st October 2011)

The Sector Skills Council for Science, Engineering and Manufacturing Technologies (2010) Skills and the future of UK Science, Engineering and Manufacturing Technologies.

The 2010 realities, expected developments and key priorities. www.semta.org.uk/PDF/SSA%20Summary%2011_03_10_Final.pdf (Accessed 31st October 2011).